REMARKS

The Final rejection in the Office Action mailed April 10, 2002, in the above-identified application, is noted. Filed concurrently herewith is a Request for Continued Examination (RCE) Transmittal for the above-identified application. The present amendments constitute the necessary Submission Under 37 CFR 1.114 for the Continued Examination. In view of the concurrently filed Request, and the present amendments acting as the Submission in connection therewith, it is respectfully submitted that the present amendments must be entered as a matter of right.

By the present amendments, Applicants have further amended the claims of the above-identified application, to further clarify the definition of the subject matter of the present invention as in the present application. Specifically, each of claims 1-8 has been amended to recite that the alloy is injection molded using a metal mold. In addition, claims 1-3, 6 and 7 have been amended to recite that the amount of tin in the alloy is "1" to 10% (by weight). Claim 8 has been further amended to correct the element to "Zn", rather than Sn, and to recite that the amount of Zn is "1" to 3% (by weight). Claim 1 has been further amended to recite that the amount of Al in the alloy is more than 10%, and up to "17%". In light of amendments to claims 1-8, claim 25 has been canceled without prejudice or disclaimer, and dependency of claim 24 has been amended.

Moreover, Applicants have added new claims 27-32 to the application. Claim 27 defines a semi-solid mold article, molded using a semi-melted state where a solid phase and a liquid phase of an alloy are mixed, this alloy being an alloy according to any one of claims 1-8. Claim 28, dependent on any one of claims 1-8, recites that

the surface of the alloy is covered with an oxide film which contains Mg of 15-35% by atoms; and claim 29, dependent on claim 28, further defines this oxide film, as further including an oxide of Al of less than 15% by atoms. Claim 30, dependent on any one of claims 1-8, recites that the surface of the alloy is covered with an inert oxide film having a defined natural immersion electric potential; and claims 31 and 32, dependent on any one of claims 1-4 and on claim 5, recite that the alloy consists essentially of the elements listed in the parent claims.

In connection with these newly added claims, note, for example, the second full paragraph on page 6, as well as page 10, of Applicants' specification.

Applicants respectfully submit that all of the claims presented for consideration by the Examiner patentably distinguish over the teachings of the references applied in the Office Action mailed April 10, 2002, that is, the teachings of the U.S. patents to Wood, No. 2,000,115, to King, et al., No. 4,332,864, to Gitlesen, No. 3,653,880, to Schulz, et al., No. 5,964,965 and to Das, et al., No. 4,675,157, the Abstract of DE1301914, the Abstract of NO20675, the Abstract of DE1259578, British Patent Document No. 1,291,553, and the Abstract of DE1934617, under the provisions of 35 USC 102 and 35 USC 103.

Initially, it is noted that while the Examiner has indicated rejection of claim 26 on the "Office Action Summary" of the Office Action mailed April 10, 2002, no basis for rejection of claim 26 has been set forth. Moreover, while Applicants submitted a Request for Clarification and for Complete Office Action on May 9, 2002, pointing out that no rejection of claim 26 was set forth in the "DETAILED ACTION" of the Office Action mailed April 10, 2002, such Request has been ignored. Accordingly, for purposes of the present Submission Under 37 CFR 1.114 (Amendment), claim

26 is being treated as not having been rejected over any one of the applied references. If the Examiner maintains rejection of claims in the above-identified application, the Examiner is respectfully requested to point out a specific basis for rejection of each and every claim in the application. See 35 USC 132.

As for the claims having a clear basis for rejection, it is respectfully submitted that the teachings of the applied references would have neither disclosed nor would have suggested a Mg based casting alloy, or article, as in the present claims, which is injection molded using a metal mold (see claims 1-8), and which contains, e.g., the specified amounts of aluminum and tin (see claims 1-8), and zinc (see claims 1-5 and 8), and manganese (see claims 1-5, 7 and 8), as well as magnesium, as in the present claims.

Moreover, it is respectfully submitted that the teachings of these applied references do not disclose, nor would have suggested, such casting alloy, and in particular the high strength casting alloy, which has crystal size of 10-300μm (see claim 2); or a tensile strength (x) at 20°C larger than 240 MPa, and an elongation (y) larger than 0.5% and at the same time larger than a value calculated by $y = -0.295x + 78$ (see claim 3); or wherein the alloy contains more than 75% Mg (see claim 4).

Furthermore, it is respectfully submitted that the teachings of these references would have neither disclosed nor would have suggested such casting alloy as in the present claims, which is injection molded using a metal mold, and which contains the specified amounts of Al, Zn, Sn and Mn, and further includes one or more than two kinds of elements selected from the group consisting of Ca, Si and rare-earth elements in a total content of less than 5%, and at least one kind of element selected from the group consisting of Sr and Sb in which the total content

thereof is less than 1% (note claim 5; note also claims 9 and 10).

Furthermore, it is respectfully submitted that these references as applied by the Examiner would have neither taught nor would suggested such die cast article, molded using a molten metal of an alloy, as in claim 11, or such semi-solid mold article, molded using a semi-melted state where a solid phase and a liquid phase of an alloy are mixed (see claim 27), with this alloy being the alloy set forth in any one of claims 1-8.

In addition, it is respectfully submitted that these applied references would have neither taught nor would have suggested such casting alloy as in the present claims, whose surface is covered with an oxide film which contains Mg of 15-35% by atoms (see claim 28); more particularly, wherein this oxide film further includes an oxide of Al of less than 15% by atoms (see claim 29).

Moreover, it is respectfully submitted that these references would have neither taught nor would have suggested such casting alloy as in the present claims, whose surface is covered with an inert oxide film having a natural immersion electric potential, 30 minutes after immersing into a specified aqueous solution at a specified temperature, which is greater than -1500 mV.

Furthermore, it is respectfully submitted that these references would have neither taught nor would have suggested such casting alloy as in the present claims, which consists essentially of the recited components. Note claims 31 and 32. Note further claims 5 and 8, reciting that the remainder of the alloy "consists essentially of" Mg.

The invention as presently claimed herein is directed to novel Mg casting alloys, which are injection molded using a metal mold, and which can be effectively

utilized for various products.

Various casting Mg alloys, such as AZ91D, have been utilized. However, with the growing need for relatively thin products, and high precision of, e.g., cast parts, to reduce weight and size of portable devices, high fluidity alloys have been required. The fluidity may be improved by raising the temperature of the molten alloy; however, raising the molten alloy temperature has problems in oxidation of the molten alloy and in shortening durable lifetime of machines used in producing parts made of the alloy. Therefore, it is necessary to improve fluidity by other methods. See the last full paragraph on page 2 of Applicants' specification.

Against this background, Applicants provide a magnesium alloy, whereby by including appropriate amounts of Al, Sn and Zn to the magnesium alloy, melting point of the alloy is lowered and fluidity is improved. Thus, the present alloy, having specific amounts of, e.g., aluminum and tin (or aluminum, tin and zinc) has high strength, with decreased melting point and improved fluidity.

As described on pages 6 and 7 of Applicants' specification, the magnesium alloys in accordance with the present invention are improved in fluidity due to lowering of the melting point, particularly by adding a small amount of Sn (at least 1% by weight) to the Mg-based alloy containing Al, and, accordingly, members having less surface defects can be obtained. Moreover, since low temperature molding can be performed and accordingly contraction at solidifying is small, members having a high dimensional accuracy can be obtained, and the molding yield can be improved. In addition, since the load on the injection machines, for example, the cylinder of an injection molding machine or the like, is decreased, durable lifetime of the machine can be lengthened. Furthermore, the magnesium

alloys in accordance with the present invention are good in mechanical properties and corrosion resistance, because of the homogenous and fine microstructure. See also the paragraph bridging pages 27 and 28, and first full paragraph on page 28, of Applicants' specification.

Attention is respectfully directed to Figs. 5 and 6 of the present disclosure, which shows that by adding Sn to the alloy No. 11, which corresponds to a conventional alloy in the AZ91D alloy family, hardness is increased, and tensile strength of the alloy increases to a remarkable extent. Amount of tin added should be 10% or less, in order to avoid disadvantageous decrease in elongation rate as shown in Fig. 7 of the present disclosure.

Attention is also respectfully directed to the Figure enclosed with the Amendment filed January 28, 2002, in the above-identified application, which shows relationships between elongation and tensile strength in Mg alloys, with data additions of conventional alloy No. 11 and AZ91D to Fig. 12 of the present disclosure. As can be seen in this Figure, an aluminum content of 10% or more in the alloy according to the present invention provides higher tensile strength. Further, since the alloy contains Sn in an amount of more than 1%, molten-flow performance of the alloy is high; this means that the alloy is highly useful as a Mg alloy for die casting and injection molding. While the high content of aluminum may decrease elongation, the alloy according to the present invention still provides an elongation of 1% or more, as stated in Applicants' specification, which is adequate for practical use.

Wood discloses magnesium-base alloys, having increased tensile strength and high yield point as well as a greatly increased elongation, the alloys containing

from 0.1-12.0% tin, from 0.5-10% of aluminum and from 0.1-1.0% of manganese. See page 1, left-hand column, lines 32-35. This patent discloses that the alloys may also include at least one of the class of metals composed of zinc and cadmium, amounts of zinc or cadmium being between 0.1% and 5.0% materially improving the corrosion resistance of the alloy without any undesirable effect on the physical properties. See page 1, right-hand column, lines 3-13. Note also page 1, left-hand column, lines 39-51.

It is respectfully submitted that this reference does not disclose, nor would have suggested, a casting alloy which is injection molded using a metal mold; moreover, it is respectfully submitted that this reference does not disclose, nor would have suggested, amounts of the various components as in the present claims, providing advantages as discussed previously, including an alloy which can be injection molded using a metal mold.

Furthermore, it is respectfully submitted that this reference does not disclose, nor would have suggested, the oxide film on the surface of the casting alloy as in various of the present claims, or other aspects of the present invention as in the present claims and discussed previously.

DE 1301914 Abstract discloses magnesium alloys of high mechanical strength at high temperatures, made by incorporating rare metals, such as Ce, in the Mg matrix in the form of silicides. This document discloses that additional elements, such as Al, Zn, Mn, Ca, Ag, Cd, Sn and Be can be incorporated to further improve mechanical properties. This document further discloses that the alloys are suitable for casting particularly when the following elements are included (max.) Zn 7, Al 10, Mn 2, Ca 1, Ag 5, Cd 5, Sn 5, and Be 0.01 wt.%.

NO 20675 discloses a Mg-base alloy containing Al .1 to req. 10, Zn .1 to req. 7, .1 to req. Mn .1 to req. 2, Ca .1 to req. 1, Ag .1 to req. 5, Cd .1 to req. 5, Sn .1 to req. 5, Be .1 to req. 0.01 wt.% and 0.5-5% rare earth metals, e.g., Ce and 0.2-3% Si.

DE 1259578 Abstract discloses Mg alloys containing metal additions, e.g., Mg9Ba, Mg2Co, Mg2Ge, Mg3Sb2, Mg2Si or Mg9Sr, which are soluble in a melt but soluble only up to 0.1% below the solidus temperature. The Abstract indicates that mechanical strength of the Mg alloys may be further improved by additions of Mn .1 to req. 2.5, Al .1 to req. 13, Zn .1 to req. 9, Ag .1 to req. 16, Bi .1 to req. 11, Ca .1 to req. 1, Li .1 to req. 15, Sn .1 to req. 16, Zr .1 to req. 1, Th .1 to req. 8, rare earth metals .1 to req. 2%.

King discloses magnesium alloys and their use in electric cells, the magnesium alloy containing 1-9% Al, 0-4% Zn, 0.1-5% Sn, and 0-1% Mn. See column 2, lines 11-19. This patent discloses that sludge formation in the cells may be reduced considerably by the use of magnesium alloys which contain minor amounts of tin. See column 1, lines 66-68.

As can be seen in the foregoing, as well as from a full review of each of the references applied in Item 3 on page 2 of the Office Action mailed April 10, 2002, none of these references disclose, nor would have suggested, a casting alloy which is injection molded using a metal mold; and it is respectfully submitted that in view of the amounts of the components in each of the applied references, these references would have neither taught nor would have suggested the casting alloy as in the present claims, which is injected molded using a metal mold, or the specific articles recited in the present claims, or specified amounts of the various components which permits accomplishment of the injection molded alloy using a metal mold, as

discussed previously.

Note that all of the present claims recite a minimum amount of tin of at least 1% by weight. Note previously considered claim 25. It is also noted that claim 25, as well as previously considered claim 8, were not included in the rejections utilizing Great Britain Patent Document No. 1,291,553, Gitlesen, and DE 1934617. See Items 4 and 5 on page 2 of the Office Action mailed April 10, 2002. Note also that neither of claims 8 and 25 were rejected over the teachings of Das, et al., in Item 7 on page 3 of the Office Action mailed April 10, 2002.

In view of present amendments to the claims, it is respectfully submitted that the rejections as set forth in Items 4, 5 and 7 on pages 2 and 3 of the Office Action mailed April 10, 2002, are moot.

Schultz, et al. discloses a lightweight Mg based material or Be based material having the ability to reversibly store hydrogen with very good kinetics. The material is of the formula $(M_{1-x}A_X)D_y$, as defined in column 4, lines 20-36 of this patent. This patent further discloses that the material is in the form of a powder of particles. See column 4, line 37.

Clearly, this reference would have neither disclosed nor would have suggested, and in fact would have taught away from, the alloy which is injection molded in a metal mold, as in the present claims, or amounts of the various components as in the present claims which provide the accomplishment that the alloy can be injection molded in a metal mold. It is emphasized that Schulz discloses material in the form of a powder of particles, which would have taught away from the alloy as presently claimed.

Comments by the Examiner in Item 8 on page 3 of the Office Action mailed

April 10, 2002, are noted. It is respectfully submitted that even assuming, arguendo, the applied references would have established a prima facie case of obviousness, the evidence of record in Applicants' specification, with respect to advantages achieved due to the various properties and amounts of the components of the alloy, overcome any such prima facie case, and further establish unobviousness of the presently claimed subject matter.

Furthermore, the contention by the Examiner that the alloys of the cited references are known for die casting such as alloy wheels, is noted. The present claims define an alloy which is injection molded, using a metal mold. Therefore, as presently amended, comments by the Examiner in connection with die casting are not relevant.

Further comments by the Examiner in connection with a cast alloy, for example, in Item 13 on page 5 of the Office Action mailed April 10, 2002, are noted. It is again emphasized that the present claims recite an alloy which is injection molded using a metal mold. Accordingly, comments by the Examiner concerning a cast alloy are not relevant with respect to the claims as presently amended.

Noting the concurrently filed Request for Continued Examination Transmittal, entry of the present amendments as the necessary Submission, and reconsideration and allowance of all claims in the application, are respectfully requested.

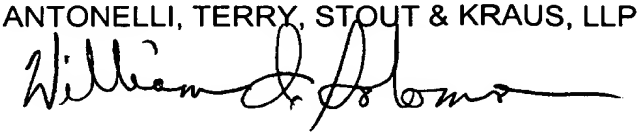
Attached hereto is a marked-up version of the changes made to the claims by the current Amendment. This marked-up version is on the attached pages, the first page of which is captioned "VERSION WITH MARKINGS TO SHOW CHANGES MADE".

To the extent necessary, Applicants petition for an extension of time under 37

CFR 1.136. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to the Deposit Account No. 01-2135 (Case No. 503.39364X00) and please credit any excess fees to such Deposit Account.

Respectfully submitted,

ANTONELLI, TERRY, STOUT & KRAUS, LLP



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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS

Please cancel claim 25 without prejudice or disclaimer, and amend the claims remaining in the application as follows:

1. (Twice Amended) A high strength Mg based casting alloy, which is injection molded using a metal mold, and which contains, by weight, more than 10%, and up to [20%] 17%, of Al; 0.1 to 10% of Zn; [more than 0.5%, and up to 15%] 1 to 10%, of Sn; and 0.05 to 1.5% of Mn.

2. (Twice Amended) A high strength Mg based casting alloy, which is injection molded using a metal mold, and which contains, by weight, more than 10%, and up to 20%, of Al; 0.1 to 10% of Zn; [more than 0.5%, and up] 1 to 10%, of Sn; and 0.05 to 1.5% of Mn, and has crystal size of 10 to 300μm.

3. (Twice Amended) A high strength Mg based casting alloy, which is injection molded using a metal mold, and which contains, by weight, 18 to 20% of Al; 0.1 to 5% of Zn; [more than 0.5%, and up] 1 to 10%, of Sn; and less than 1.5% of Mn, and has a tensile strength (x) at 20°C larger than 240 MPa; and an elongation (y) larger than 0.5% and at the same time larger than a value calculated by $y = -0.295x + 78$.

4. (Twice Amended) A high strength Mg based casting alloy, which is injection molded using a metal mold, and which contains, by weight, 12 to 15% of Al;

0.1 to 5% of Zn; 1 to 10% of Sn; 0.1 to 0.5% of Mn, and the remainder contains Mg more than 75%.

5. (Twice Amended) A high strength Mg based casting alloy, which is injection molded using a metal mold, and which contains, by weight, 12 to 15% of Al; 0.1 to 5% of Zn; 1 to 10% of Sn; 0.1 to 0.5% of Mn; one kind or more than two kinds of elements selected from the group consisting of Ca, Si and rare-earth elements of which the total content is less than 5%; at least one kind of element selected from the group consisting of Sr and Sb of which the total content is less than 1%; and the remainder which is consisting essentially of Mg.

6. (Twice Amended) A Mg based casting alloy, which is injection molded using a metal mold and which contains, by weight, 12 to 20% of Al; and [more than 0.5%, and up] 1 to 10%, of Sn.

7. (Twice Amended) A Mg based casting alloy, which is injection molded using a metal mold, and which contains, by weight, 2 to 20% of Al; [more than 0.5%, and up] 1 to 10%, of Sn; and less than 1.5% of Mn.

8. (Twice Amended) A high strength Mg based casting alloy, which is injection molded using a metal mold, and which contains, by weight, 10 to 15% of Al; [0.5] 1 to 3% of [Sn] Zn; 1.5 to 4.5% of Sn; 0.05 to 0.5% of Mn; and the remainder which is consisting essentially of Mg.

24. (Amended) The Mg-based casting alloy according to claim [1 or] 2, wherein the alloy includes at least 12%, and up to 20%, of Al.